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Research Article

Analyzing Noise Pollution in Dr. Sami Yağız Street in Niğde

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Abstract

One of the pollutant sources that negatively affects our health today is the noise problem, whose impact is felt more and more every day. In our cities where various activities are carried out, noise pollution, like other types of pollution, has reached levels that cause discomfort to people and the environment. Conditions such as the frequency of the noise, the duration of its presence in the environment, whether the noise originates from a point, planar, or linear source, and mental state of the person exposed to the noise, and the distribution of the noise over time in the environment are important factors in the perception of noise as a disturbance by the receiver. This study investigated one of the most frequently used areas in Niğde, the environmental noise pollution of Dr. Sami Yağız Street. 25 measurement locations were determined in different parts of the street, and measurements were made at 3-hour intervals on weekdays, from 9.00 to 18.00, to determine the sound level in these places for weekdays. The highest sound level was 86.43 dBA at 09:00 and 89.50 dBA at noon, 87,68 dBA at 15:00, and 88,85 dBA at 18:00 according to the measurement. The highest level at all times occurred on Mondays. According to the results, it was seen that most of the sound levels measured at the measurement points were higher than the noise limit values. As a result, it was determined that environmental noise pollution was significant in the city center of Niğde.

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Niğde Dr. Sami Yağız Caddesinin Gürültü Kirliliği Açısından İncelenmesi

Özet

Günümüzde sağlığımızı olumsuz etkileyen kirletici kaynaklardan biri de etkisi her geçen gün daha fazla hissedilen gürültü sorunudur. Çeşitli faaliyetlerin yürütüldüğü şehirlerimizde, diğer kirlilik türleri gibi gürültü kirliliği de insanlara ve çevreye rahatsızlık verecek seviyelere ulaşmıştır. Gürültünün sıklığı, ortamda bulunma süresi, gürültünün noktasal, düzlemsel veya doğrusal bir kaynaktan gelip gelmediği, gürültüye maruz kalan kişinin ruhsal durumu ve gürültünün ortamdaki dağılımı gibi durumlar ortamda geçirilen süre, gürültünün alıcı tarafından rahatsızlık olarak algılanmasında önemli faktörlerdir. Bu çalışmada, Niğde'nin en sık kullanılan alanlarından biri olan Dr. Sami Yağız Caddesi'ndeki çevresel gürültü kirliliği araştırılmıştır. Sokağın farklı yerlerinde 25 ölçüm noktası belirlenerek, 1 hafta boyunca bu mekanlardaki ses düzeyinin belirlenmesi amacıyla hafta içi 9.00-18.00 saatleri arasında 3'er saatlik aralıklarla ölçümler yapılmıştır. Yapılan ölçüme göre en yüksek ses düzeyi saat 09:00'da 86,43 dBA, öğlen 89,50 dBA, 15:00'de 87,68 dBA, 18:00'de 88,85 dBA olarak gerçekleşmiştir. En yüksek ses seviyeleri Pazartesi günleri görülmüştür. Sonuçlara göre ölçüm noktalarında ölçülen ses seviyelerinin büyük çoğunluğunun gürültü sınır değerlerinin üzerinde olduğu görülmüştür. Sonuç olarak Niğde il merkezindeki çevresel gürültü kirliliğinin önemli düzeyde olduğu belirlenmiştir.

Anahtar Kelimeler:
Gürültü,
Gürültü Kirliliği,
Cadde,
Peyzaj, Niğde

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Introduction

Noise, which has a negative impact on hearing health, reduces the performance of living things by disrupting their physiological and psychological balance, and disrupts the peace of living creatures in the environment, is an important environmental problem consisting of sounds at irregular intervals [1].

It is reported that noise can cause serious problems for all age groups (Merkit and Olmaz, 2019) [2], and especially people living in cities experience high noise exposure above 75 dBA. Noise causes temporary or permanent health problems. These problems include physical effects such as feeling of pain, nervous and circulatory system disorders, and disruption of hormone balances; Psychological effects such as discomfort, sleep disturbance, fatigue, restlessness, lack of concentration and irritability are observed, and the most important permanent effect of noise occurs on the sense of hearing. Inability to understand what is being said, sensitivity to sound, decreased ability to understand in noise, dizziness, etc. It is stated that many signs and symptoms reduce job security by preventing conversations [3]. In parallel with unplanned urbanization, there is an increase in noise in cities. Providing acoustic comfort in working and living spaces can be achieved by creating structures suitable for the purpose of use and applying the most appropriate solution to the noise problem. The fact that the noise level is at an acceptable level within the building does not mean that acoustic comfort is provided; noise emission occurs from more than one source outside the buildings. Among these sources; transportation noise, construction site noise, industrial noise and various noises resulting from commercial activities [4,5].

Although there are many reasons for noise pollution, the main reasons are; rapid population growth and industrialization and the rapid and unplanned urbanization that comes with them.The main noises that cause environmental pollution are: traffic noise (land, sea and air), noise resulting from outdoor activities such as sports fields, playgrounds and marketplaces,

indoor and outdoor workplace and industrial noise, construction noise and commercial noise such as casinos, coffee houses and wedding halls. They are purposeful noise [6]. It has begun to be better understood through research that noise pollution can negatively affect humans, animals, plants and the natural environment.

Studies examining the effects of noise on health have been conducted and continue to be conducted. Many local and foreign studies indicate that the negative effects of noise are significant and numerous [7]. Human behaviors against the effect of noise are divided into two groups. The first is psychological discomfort, which can only be determined by explaining feelings and sensations, and the second is; It is a physiological disorder that can be determined by various measurement methods. For this reason, noise control must be carried out at the architectural design stage in terms of human health and comfort conditions [8]. Of course, it should not be forgotten that there are many factors that need to be taken into consideration, such as sound elasticity, volume, intensity, exposure type, duration and type of noise. Table 1 provides a classification of the effects of noise [9]

Table 1. Noise impact classification [6,9]

Degree	Effect
Degree I Noises (30 – 65 dBA)	Discomfort Discomfort Feeling of Boredom Anger Concentration Sleeping Disorder
Degree II Noises (65 – 90 dBA)	Physiological Noise Change of Heartbeat Respiratory Acceleration Decreased Pressure in the Brain
Degree III Noises (90 – 120 dBA)	Physiological Noise Headache
Degree IIII Noises (120 – 140 dBA)	Inner ear disorder
Degree IV Noises (> 140 dBA)	Burst Eardrum

People may differ in their perception of acceptable noise. In this respect, the concept of sound is defined as objective, while noise is defined as subjective.

People's tolerance determines which sounds are noise [10]. In a study covering European countries, it was determined that 32% of a total of 371,602,000 people living in these countries were affected by noise above 55 dBA and 13% were affected by noise above 65 dBA [9,11,12].

When the literature is examined, it can be seen that there are many studies aimed at determining the indoor and outdoor noise in buildings. In educational buildings [4, 12-18], in workplaces [19-23], in health structures [3,5,24-25] noise detection studies were carried out in urban buildings where commercial activities are carried out [26-29]. In the noise determination study carried out in the outpatient clinics at Istanbul University Cerrahpaşa Faculty of Medicine, it was determined that the average noise values measured were above the average levels of 30 dBA and 45 dBA, which are the average levels determined by the World Health Organization (WHO) and the Environmental Protection Agency (EPA) [30].

In the study where the acoustic insulation status of four schools in Bursa was investigated, noise and reverberation measurements were made in the schools. The measurements were compared with WHO and the Regulation on the Protection of Buildings Against Noise, and it was determined that the noise level in the classrooms was above the limit values determined by the regulations [17].

In the noise measurement study carried out in a closed market place in Nilüfer district of Bursa province, the noise values obtained were compared with the limit values given in the Regulation on the Evaluation and Management of Environmental Noise and it was determined that the majority of the measurements were above the determined limit values, and especially evening measurements carried a high risk in terms of noise. [29]. In this study, the central

district of Niğde province, the environmental noise level on Dr. Sami Yağız Street has been determined. Observations were made in the region and measurements were made on weekdays, Mondays, Tuesdays, Wednesdays, Thursdays, and Fridays, in the morning, at noon, and in the evening, at the points where noise occurs intensively, and the noise level was determined and the precautions that can be taken against the noise are listed. Although there are many studies to determine the level of noise pollution in many provinces, no study has been found to determine the noise pollution in Niğde province. This study has a unique value as it is the first study to detect noise pollution in Niğde province. There are no limiting factors in the study.

Materials and Method

In this study, to determine the environmental noise level in the city center of Niğde, measurements were made at certain hours on the street where traffic and population are dense and the results obtained are presented. Niğde is bordered to the south by Mersin, to the west by Konya, to the north by Nevşehir, to the northeast by Aksaray, and to the east by Kayseri (Figure 1). Thus, the primary data for the study comes from Dr. Sami Yağız Street and the area around it. One of Niğde Province's longest streets, Dr. Sami Yağız Street is around 1.5 km long and 15 meters wide. The coordinates of Dr. Sami Yağız Street are 34.672649 longitudes and 37.966373 latitudes (Figure 2).

In the study, first of all, Dr Sami Yağız Street was mapped and sensitive points in terms of noise were determined. Measurements were taken at these designated points during the morning, noon and evening hours on Mondays, Tuesdays, Wednesdays, Thursdays and Fridays. The measurements were chosen considering the start-end hours of work, which are the hours when noise is intense, and measurements were made at 09:00 in the morning, 12:00 noon - 15:00 and 18:00 in the evening. Measurements were made on days when the weather was dry and the wind was calm and light.

Figure 1. Location of the study area

Since the measurements were made in good weather conditions, meteorological data were not recorded as it was thought that they did not have a significant effect on the measurements.

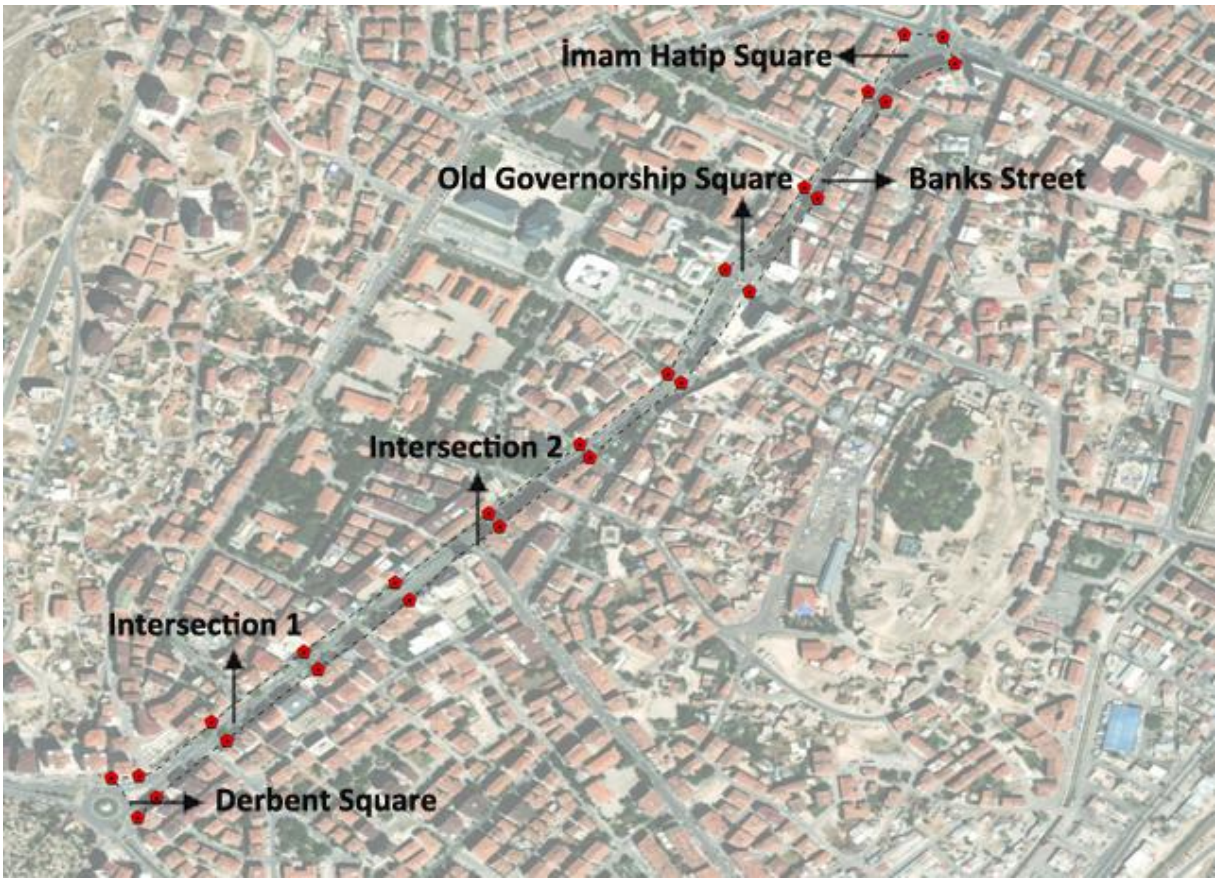

Figure 2. Dr. Sami Yağız Street and measurement points

EXTECH 407738 (Sound Level Meter) was used as measurement material throughout the study (Figure 3).

Figure 3. Measurement tool

The measuring material meets Type 2 standards (ANSI S1.4 1983, IEC 60651, EN 60651) and has high precision. It has a wide measurement range of 26 dB to 130 dB and is an ideal tool

for various environments where noise measurement will be carried out. After transferring the acquired information to the ArcGIS 10.3 program, maps were created. By using the maps, it was possible to ascertain when times of day the sound density varied, as well as which areas of the roadway and why.

Results and Discussion

Urban noise levels are especially important in places with high human density. These places are institutions where people collectively meet their education and treatment needs and where noise exposure is at high levels, and they are large action areas that include various activities such as rest, entertainment, travel, and free time, which enable people to regain themselves physically and psychologically. According to the measurement results, the highest sound level was 86.43 dBA measured on Monday. Also, the lowest sound level was measured as 53.66 dBA on Monday. According to the Regulation on Evaluation and Management of Environmental Noise, it has been stated that a sound level above 65 dBA is not appropriate. According to the World Health Organization, this value is 55 dBA. When both regulations are examined, according to the measurement results made on the street, the area has a high noise level. This is a sound level that not only causes physical discomfort, but also can cause heart rate changes, breathing acceleration and decreased pressure in the brain (see Table 1). According to on-site observations, the human density is low in the morning hours, and the main factor causing noise is the vehicle density and the loud sound it causes. The most important factor that causes loud noise, especially in squares and intersections, is traffic density. The results of the measurements for 09:00 are given in Figure 4.

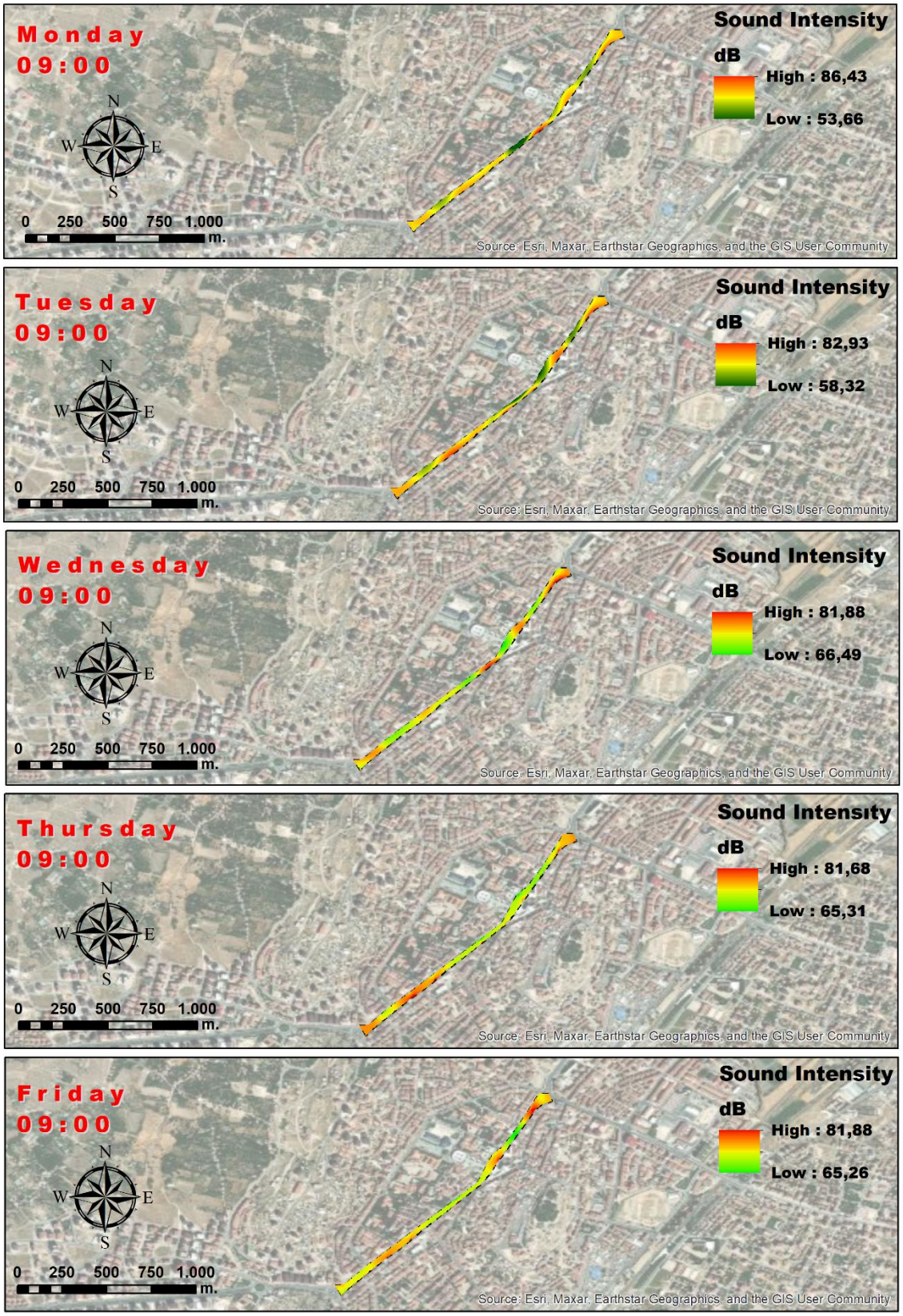

Figure 4. Sound measurement – 09:00

The results of the measurements for 12:00 are given in Figure 5. According to the measurement results, the highest sound level was 89.50 dBA measured on Monday. The

lowest sound level was measured as 58.24 dBA on Tuesday. When both regulations are examined, according to the measurement results made on the street, the area has a high noise level. When the measurements made at 12:00 were applied, it was determined that the most intense reason for loud noise was not due to traffic, but due to human density. It has been determined that there is a high level of noise during this time period, as there are lunch breaks for working people and there are many eating and resting areas on the street. That's why areas with high noise levels are concentrated on the streets, not intersections.

The results of the measurements for 15:00 are given in Figure 6. According to the measurement results, the highest sound level was 87.68 dBA measured on Monday. The lowest sound level was measured as 66.15 dBA on Wednesday. When both regulations are examined, according to the measurement results made on the street, the area has a high noise level. The main reason for loud noise during this time period is both traffic and heavy use of the street by people. It has been determined that the Banks Street, located in the second part of the street, was used intensively during this time period. People who want to carry out their business in the bank cause noise in terms of both traffic and human density. For this reason, noise occurs in intersections and squares due to school dismissal hours. The results of the measurements for 18:00 are given in Figure 7. According to the measurement results, the highest sound level was 88.85 dBA measured on Monday. The lowest sound level was measured as 58.24 dBA on Wednesday. When both regulations are examined, according to the measurement results made on the street, the area has a high noise level. The main reason for loud noise during this time period is both traffic and heavy use of the street by people. It is time to return from work and that university students use the restaurants on the street extensively causes noise.

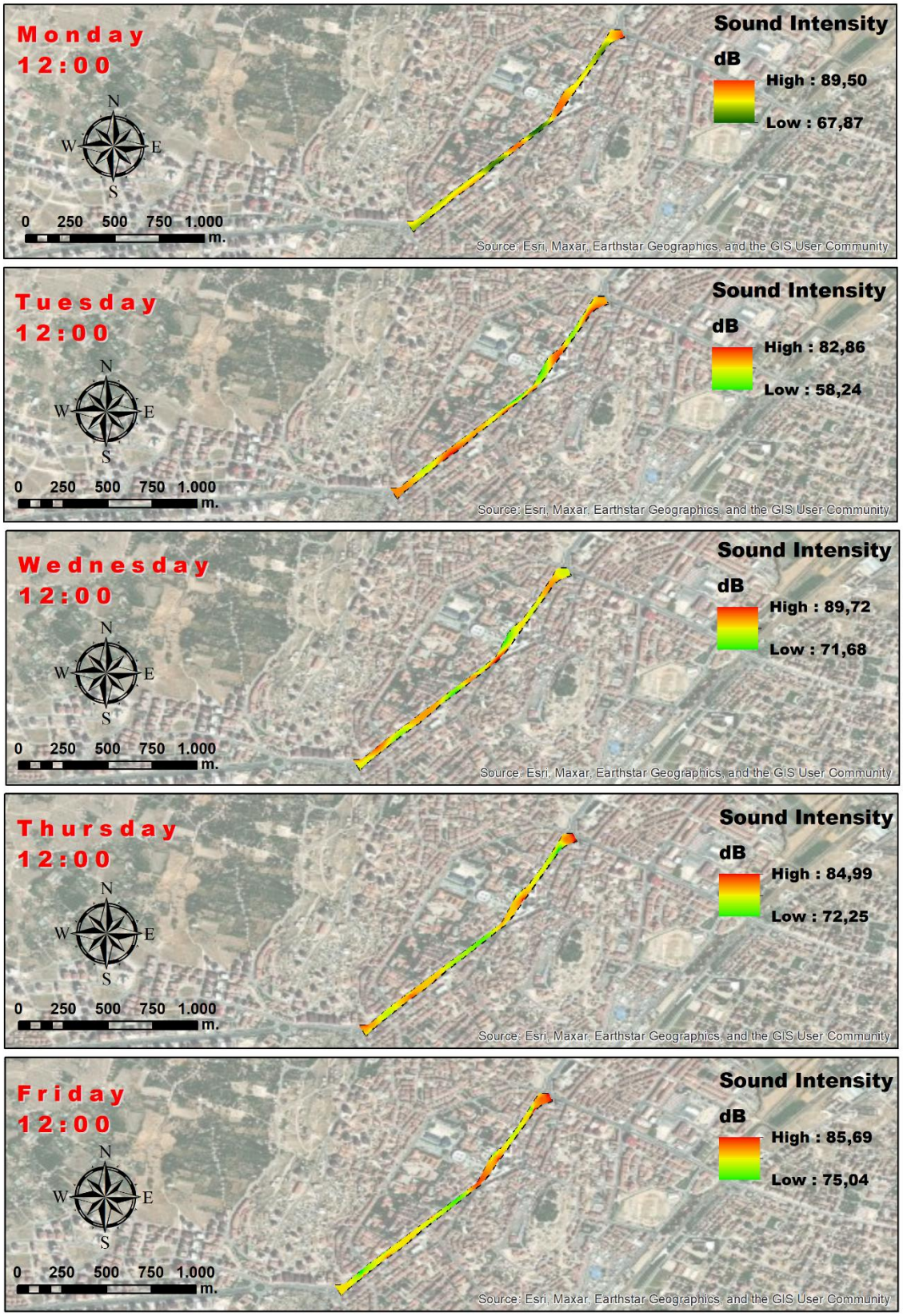

Figure 5. Sound measurement – 12:00

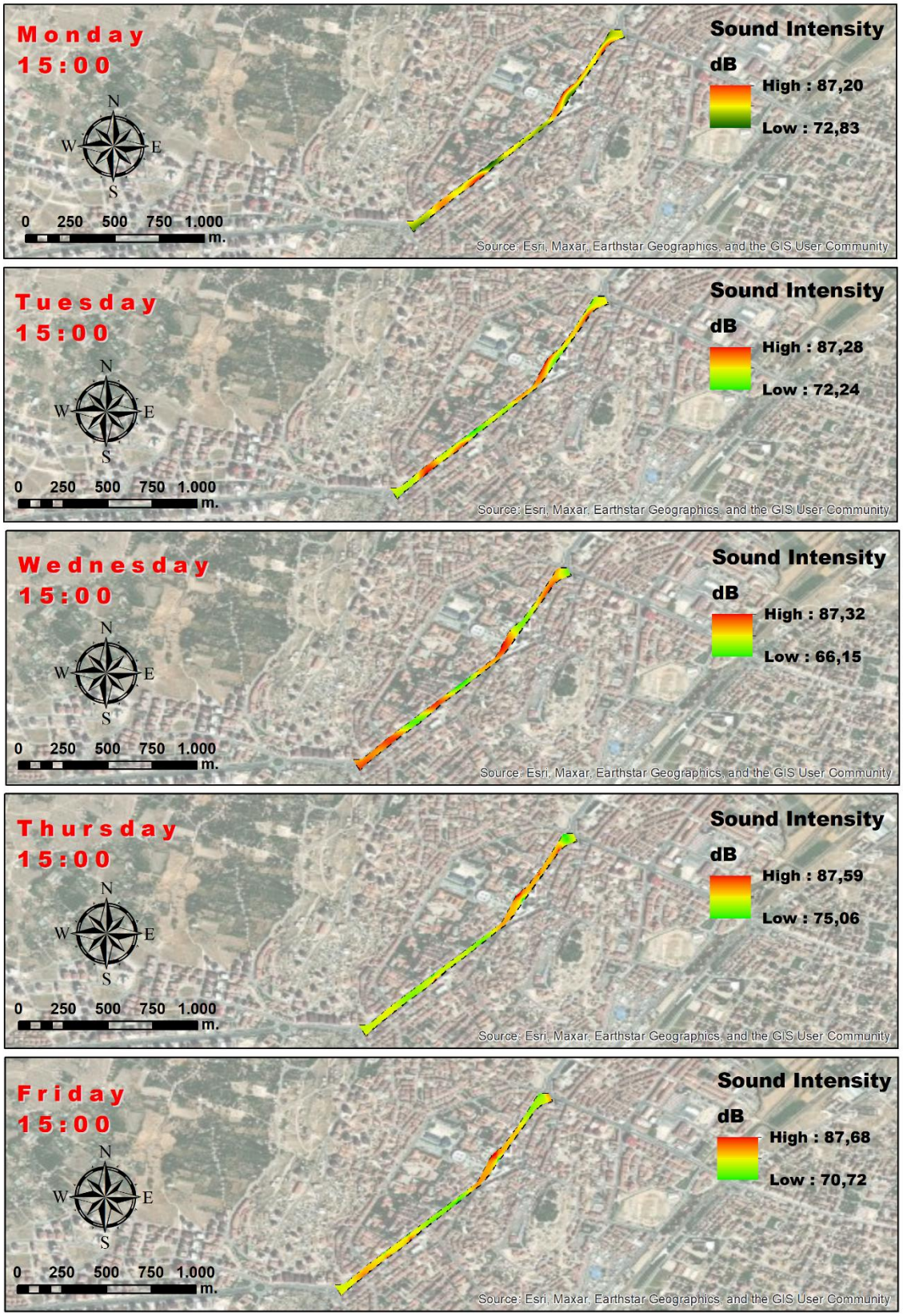

Figure 6. Sound measurement – 15:00

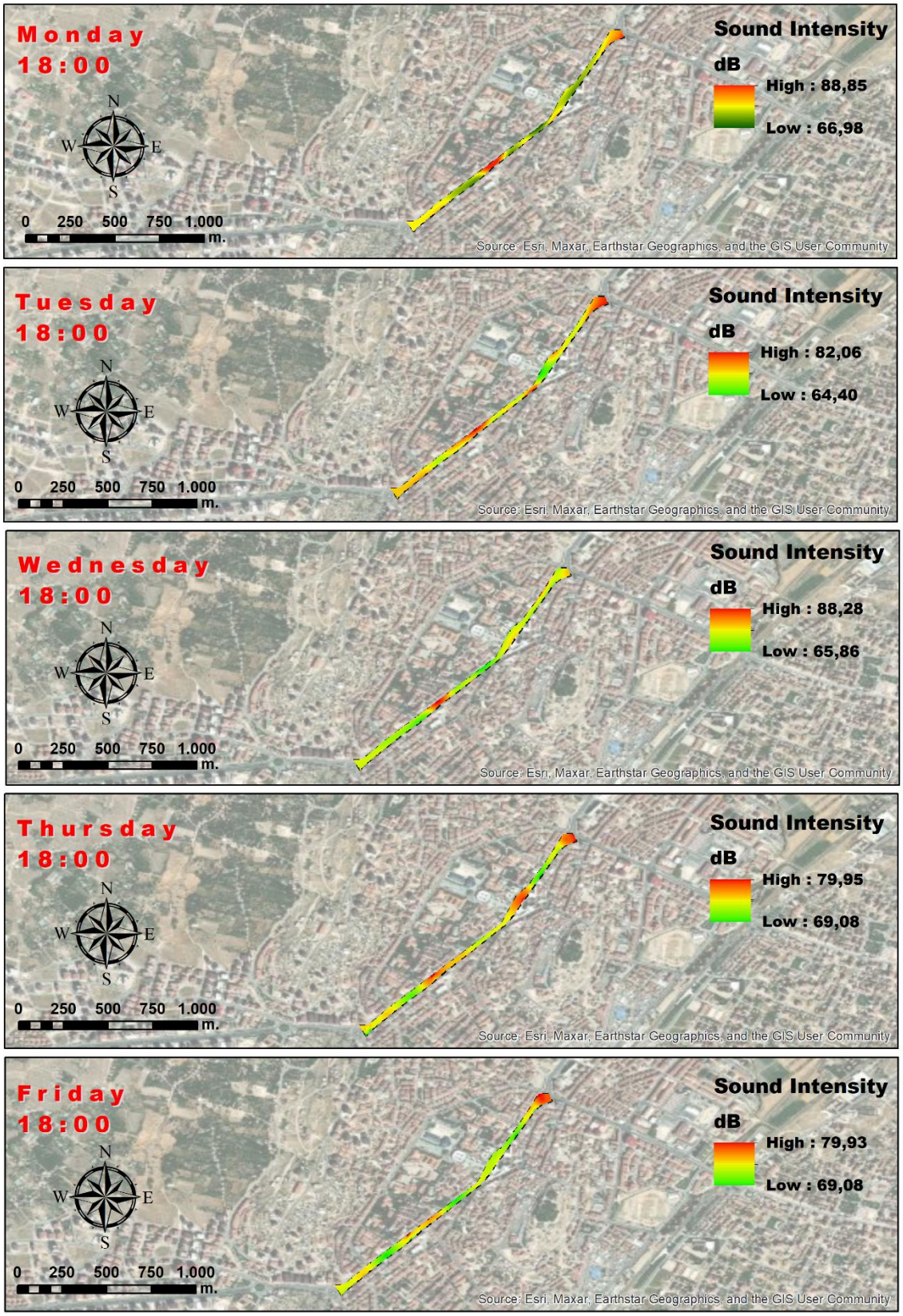

Figure 7. Sound measurement – 18:00

When the study was compared with other studies conducted on the street, similar results were obtained. In the study conducted by Badur, a noise map of Gaziantep city center was

prepared. It has been determined that noise levels in Gaziantep city center are within the very dangerous limits in 10 centers, dangerous in 23 centers, and medium hazardous in 4 centers, according to ISO criteria in noise measurements. It was determined that the noise level originating from the main arteries was above 76 dBA in many boulevards and streets measured [31]. When the traffic-related noise level in the main arteries in Gaziantep city center is compared to Giresun city center, it is concluded that the noise level in Gaziantep is approximately 4-10 dBA higher. In the study conducted by Dursun and Özdemir, the noise pollution map of Konya city center was prepared. In the centers where measurements were made in the city, it was revealed that architectural features directly affected the noise generated and it was determined that the 65 dBA limit was exceeded in all regions [32]. In the measurements made in Giresun city center, when the average of the measurements made in the morning, noon, and evening hours was taken, the noise level exceeded 68 dBA in 24 of the 99 measurement stations, in 31 of them it was in the range of 60-68 dBA, in 29 of them it was in the range of 55-60 dBA, in 13 of them the noise level exceeded the value of 68 dBA. It was determined that 2 of them were in the range of 50-55 dBA and 2 of them were in the range of 45-50 dBA.

Conclusion

One of the pollutant sources that negatively affects our health today is the noise problem, whose impact is felt more and more every day. Considering the international criteria, when we look at the noise levels obtained at the measurement points, the noise level is at an unacceptable level in almost all of the measurement areas. The presence of public buildings and private workplaces such as, schools, municipalities, governorships and other public buildings near the noise measurement points, resulting in an increase in traffic and human density and the narrowness of the streets in these places cause an increase in noise (Figure 8 - 9). As a result, the noise levels measured at the measurement points exceed the limit values

of 65 and 55 dBA. In addition, it is thought that people in important places such as hospitals and schools are negatively affected due to the high noise levels measured in these places.

Figure 8. a) İmam Hatip Square b) Banks Street [31]

Figure 9. Restaurants on the street [31]

People using the street must be exposed to these negative effects of noise. In addition, the noise values obtained at all measurement points exceed the limit value of 55 dBA determined by the World Health Organization. Environmental noise pollution in cities significantly affects human life and health. Although Niğde is not a small and non-industrialized city, it has been

revealed that environmental noise pollution is at a significant level as in big cities. Especially the narrow streets and streets and the high number of vehicles cause the impact and importance of traffic noise, which causes environmental noise, to become more noticeable. In addition, the concentration of public buildings in the city center increases the density of people there, which also increases the effect of noise caused by human activities. As a result, this study revealed that environmental noise pollution is at a significant level in Niğde.

Some measures can be taken to reduce the impact of environmental noise. Especially in terms of traffic; Road pavements can be changed, intersections, bends and lights can be arranged to ensure non-stop traffic flow or minimum stopping, and traffic density can be reduced by moving traffic from densely dense areas to less dense areas. In addition, moving public buildings (Governorship, Municipality, etc.) in the city center to less dense locations will reduce both vehicle and human density. Thus, these measures will reduce environmental noise [6]

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